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(54) Maximal concurrent lookup cache for computing systems having a multi-threaded environment

(57) A multi-threaded processing system has a cache that is commonly accessible to each thread. The cache has a plurality of entries (201) for storing items, each entry being identified by an entry number. The location in the cache of an item that includes a first key (203) is determined by supplying the first key to a lock-less-lookup engine which then provides a lookup output that is alternatively a lookup entry number or an indication that the item is not stored in the cache. The lookup entry number is alternatively a first or second entry number, wherein the first entry number points to a first entry in which the item is stored and the second entry number points to a second entry in which the item is not stored. If the lookup output is the lookup entry number, then it is verified that the lookup entry number is the first entry number. This verification includes acquiring a mutual exclusion lock on the entry designated by the lookup entry number, using the lookup entry number to read a stored key from the cache, and comparing the first key with the stored key. If the two keys match, then the item has been located. Other aspects of the invention address the situations where the two keys do not match, or where the lookup output is the indication that the item is not stored in the cache.
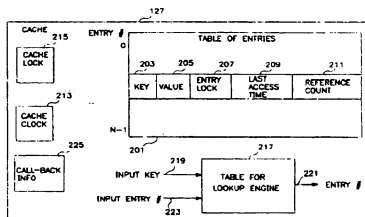
FIG. 2

EP 0 768 608 A3

BNSDOCID: <EP___0768608A3_I_>

European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 96 30 7364

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	AGARWAL A ET AL: "COLUMN-ASSOCIATIVE CACHES: A TECHNIQUE FOR REDUCING THE MISS RATE OF DIRECT-MAPPED CACHES" 16 May 1993 , PROCEEDINGS OF THE ANNUAL INTERNATIONAL SYMPOSIUM ON COMPUTER ARCHITECTURE, SAN DIEGO, MAY 16 - 19, 1993, NR. SYMP. 20, PAGE(S) 179 - 190 , INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS XP000398997 * page 180, right-hand column, paragraph 3 - page 181, right-hand column, paragraph 3.1; figures 3,4 *	1,2,5,9, 10,13,17	G06F12/08 G06F12/12
A	WO 94 03856 A (MASSACHUSETTS INST TECHNOLOGY) 17 February 1994 * page 8, line 6 - page 10, line 11; figure 2A *	1,2,10	
A	EP 0 061 570 A (IBM) 6 October 1982 * page 13, line 15 - line 33; figure 2 *	1,2,10	
A	"AN EFFICIENT AND FAIR MEMORY AGING SCHEME" RESEARCH DISCLOSURE, no. 324, 1 April 1991, page 228 XP000147272 * the whole document *	27,28	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G06F
A	EP 0 568 221 A (SUN MICROSYSTEMS INC) 3 November 1993 * column 6, line 50 - column 8, line 31; figures 3-5 *	27,28	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 June 1998	Ledrut, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

European Patent Office

Application Number

EP 96 30 7364

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number

EP 96 30 7364

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-26

    Method and apparatus for locating an item in a cache using a lockless-lookup engine

2. Claims: 27-29

    Method and apparatus for obtaining a new cache entry for storage of a new item and comprising more precisely the selecting of an entry in a set for a replacement operation